INTERNATIONAL POLAR YEAR 2007-2008: THE OPPORTUNITY OF A GENERATION

Statement of

Dr, Robin Elizabeth Bell
Doherty Senior Research Scientist
Lamont-Doherty Earth Observatory of Columbia University
and
Chair, Polar Research Board
US National Committee for International Polar Year
Division on Earth and Life Studies
National Research Council
The National Academies

before the

Subcommittee on Research
Committee on Science
U.S. House of Representatives

September 20, 2006

Good Morning. Thank you very much for inviting me to speak about International Polar Year 2007-2008. The International Polar Year (IPY) is the scientific opportunity of a generation for our nation, for our society, and for our planet.

My name is Robin E. Bell, PhD from Columbia University's Lamont-Doherty Earth Observatory, where I am a Doherty Senior Research Scientist. I am a geophysicist by training and at Columbia I lead major geophysical programs on the stability of ice sheets including subglacial lakes. I also direct Columbia's NSF sponsored ADVANCE program, aimed at recruiting and retaining women in science. I was the first women to lead a major aerogeophysical program from the Antarctic continent, and this has been the focus of much of my research for the past 2 decades.

In addition to my research I chair the National Research Council's Polar Research Board, which acts as the national coordinating committee for IPY. The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, chartered by Congress in 1863 to advise the government on matters of science and technology. I served as the Co-Chair of the International Council for Science's (ICSU) initial IPY Planning Group, which developed the first major international IPY planning document. "A Framework for International Polar Year." I currently serve on the ICSU-WMO Joint Committee for IPY, the main international planning group.

Today I will provide an overview of why IPY is happening and why it's important to us here in the United States. What has motivated more than 5000 scientists from some 63 nations to decide to participate in a year devoted to polar studies and education? I'll highlight the major science questions that will be addressed, outline the role that US scientists and science managers have been playing developing IPY, and conclude with thoughts on the many societal benefits that can result from the IPY.

In this era of instant communications and global connectivity, it might seem surprising that the global scientific community is so excited by a scientific strategy that was developed more than 100 years ago. Because it was indeed back in 1882-1883 that the idea of holding a focused, internationally-coordinated year of polar research – an International Polar Year – was first developed. At that point in history, the poles were blank white spaces on maps and the cutting edge communications technology was the

telegraph. The decision to coordinate with other nations rather than compete, and to focus on research to understand polar phenomena rather than acquisition of territory, was something new and exciting. That first IPY in 1882-83 and subsequent ones in 1932-33 and the International Geophysical Year (IGY) in 1957-58, drew great minds and generated great leaders; these "international years" set a precedent of cooperation in science that, while innovative at the time, is considered the norm today.

Today's scientists are similarly motivated by society's need for integrated global knowledge. There is still a fundamental human need to push the limits of our understanding about polar phenomena. The polar regions are integral components of the Earth system. As the heat sinks of the climate system they both respond to and drive changes elsewhere on the planet. While environmental change and variability are part of the natural pattern on Earth, the environmental changes currently witnessed in the polar regions are in many cases more pronounced than changes observed in the mid-latitudes or tropics. The Arctic sea ice cover is decreasing; some ice shelves in Antarctica are retreating and thinning; glaciers are shrinking; and ecosystems are changing, for instance, with plants flowering at earlier times. These changes are having human impacts: some Alaskan villages have been moved to higher ground in response to rising sea levels, and thawing of permafrost is undermining roads and buildings in northern communities around the world. We must understand the implications of environmental change for the future of our global society.

Although we've made tremendous progress in all science over the past 100 years, the polar regions are still at the frontiers of human knowledge. The maps aren't quite as blank, but the frontiers and unknowns have actually increased, and range from the molecular, to the ecological, to the continental. How is it that certain microbes can survive at minus 2 degrees Fahrenheit, that certain nematodes live even when ice forms in their cells, that polar fish species have evolved with an antifreeze protein in their blood? What will happen to the unique under-ice ecological communities of the Arctic, which are the base of the Arctic food web, as ice conditions change and new species arrive from southern waters? In just the last 10 years we discovered more than 150 subglacial lakes that exist under the ice in Antarctica. These range in size from something similar to the reflecting pool on the Mall to a lake the size of Lake Ontario.

Why are these lakes important? They are thought to contain exotic ecosystems; the water in these lakes is part of the subglacial plumbing system that can be thought of as the lubricant that makes the ice sheet flow faster.

At its most fundamental level, IPY 2007-2008 is envisioned to be an intense, coordinated field campaign of polar observations, research, and analysis that will be multidisciplinary in scope and international in participation. IPY will provide a framework to undertake projects that normally could not be achieved by any single nation. It allows us to think beyond traditional borders—whether national borders or disciplinary constraints—toward a new level of integrated, cooperative science. A coordinated international approach maximizes both impact and cost effectiveness, and the international collaborations started today will build relationships and understanding that will bring long-term benefits. Within this context, IPY will seek to galvanize new and innovative observations and research while at the same time building on and enhancing existing initiatives. IPY will serve as a mechanism to attract and develop a new generation of scientists and engineers with the versatility to tackle complex global issues.

In addition, IPY is clearly an opportunity to organize a range of education and outreach activities designed to excite and engage the public, with a presence in classrooms around the world and in the media in varied and innovative formats. The IPY will use today's powerful research tools to better understand the key roles of the polar regions in global processes. Automatic observatories, satellite-based remote sensing, autonomous vehicles, Internet, and genomics are just a few of the innovative approaches for studying previously inaccessible realms. IPY 2007-2008 will be fundamentally broader than past international years because it will explicitly incorporate multidisciplinary and interdisciplinary studies, including biological, ecological, and social science elements.

IPY 2007-2008 is an opportunity to deepen our understanding of the polar regions and their global linkages and impacts, and to communicate these insights to the public. IPY planners have identified five broad scientific challenges to be addressed:

- Assessing large-scale environmental change in the polar regions, with questions looking at both the physical and human dimensions of change and its impacts.
- Conducting scientific exploration of "new" frontiers, whether these are once

inaccessible places beneath the ice sheet, or areas of inquiry that are now open because of advances in technology, such as how the tools of genomics now allow exploration of previously unanswerable questions about biological adaptation.

- Observing the polar regions in depth, with adequate coverage of the vast and challenging landscape, to provide a description of current conditions and allow for better future understanding of variability and change.
- Understanding human-environmental dynamics in a region where the connections are intimate and where the impacts of change are clear.
- Creating new connections between science and the public, using these regions that are inherently intriguing.

One of the major differences between the first two IPYs and IGY and our upcoming IPY 2007-2008 is the recognition that the physical world and the biological world and human society are intimately interrelated. This upcoming IPY is inherently about not just science, but science in support of human interests. It includes work in engineering, medicine, sociology, and human-environment interactions. The present map of 225 IPY projects highlights the geographic and discipline breadth of the IPY 2007-2008. Each cell represents a major program with an international team of scientists working together to advance our knowledge of our planet – producing a tremendous multiplicative effect. The net result will be a huge leap forward in our understanding of polar processes – physical, biological and social - and their global connections.

Previous IPY efforts were characterized by very top down planning and generally driven by the military. For example, under the oversight of Abraham Lincoln's son, Robert Todd Lincoln, then head of the Department of War, the US participation in the first IPY in 1882-82 was led by the Army. The science priorities for our upcoming IPY, on the other hand, emerged from grass roots planning, international scientific groups, US agency input, and help from the US National Academy of Sciences and National Academy of Engineering.

Beginning in 2002, with the support of more than two dozen members, the National Academies invested some of its own endowment funds to launch the IPY planning process within the US. The chair of that first effort was Dr. Mary Albert of the

Army's Cold Regions Research and Engineering Laboratory. She led a committee that sought wide input on whether the US should participate in IPY and, if so, what we should hope to accomplish. The committee led a series of web discussions, gave talks at numerous professional meetings, met with agency leaders, hosted a multi-day workshop, and compiled contributions from 13 federal agencies into an initial planning document. The report, "A Vision for International Polar Year 2007-2008." was released early in 2004 and came to be the foundation for much of the international planning as well. (A summary of this report is attached to my testimony.) This early investment of financial and intellectual capital put the US in a position to play a leadership role in planning the IPY internationally.

Today, four years after the planning for IPY began, over 225 projects have been proposed as part of IPY around the globe. Of these, the US plays a leadership role in 52 projects (20%) and is participating in 80%. This "honeycomb diagram" provides an illustration of the breadth of activities, with projects at both poles, across disciplines, and across nations. Right now, everything is still conceptual – what will actually happen on the ground is still being determined, both here and in other nations. There is an international IPY Programme Office, staffed by Dr. David Carlson and hosted in Cambridge, England, by the British Antarctic Survey. There is also an international planning committee, called the Joint Committee, of which I am a member, and various subcommittees devoted to data management, observation systems, and education and outreach. It's a very lean administrative organization for such a complex undertaking.

While planning for IPY started with the scientific community, all the federal agencies with cold regions responsibilities are having roles in implementation. When the National Academies hosted a workshop to encourage agency coordination in 2004, 13 agencies participated. At the request of the White House, the National Science Foundation is serving as the lead federal agency. (In Alaska, the University of Alaska Fairbanks has stepped forward as the state-wide leader.) NSF has shown real leadership in its role, holding interagency planning meetings, initiating a multi-agency website, and establishing mechanisms so that science and education/outreach proposals are in the process of being funded. The National Academies continues to provide coordination through the Polar Research Board, which acts as the US National Committee for IPY.

The Polar Research Board hosts an IPY website, distributes an IPY e-newsletter, communicates information to and from the international Joint Committee, and holds meetings as needed to accomplish IPY planning and coordination. Continuing to serve in this coordinating role, in early October, the Polar Research Board will be hosting a meeting of the IPY secretariats so the staff working on IPY behind-the-scenes have an opportunity to coordinate.

In conclusion, I want to think ahead about the societal benefits of the International Polar Year. Just as the IPY and the emerging science programs are multifaceted and multidisciplinary, the benefits of the IPY will be multifaceted and multidisciplinary. The IPY will advance our fundamental understanding of our planet – from the polar ecosystems to the subglacial terrains. The IPY will improve our understanding of the processes of change and that complex double-edged sword of how society is influencing change and how change is influencing society – especially the inhabitants of the north. The IPY will inspire a spirit of discovery across all ages and help us develop the next generation of our nation's leaders in science, engineering, education, industry, commerce, and government. At the international level, IPY will again show that even in the most difficult times, science can be an arena of international cooperation. IPY will foster the continued peaceful use of the polar regions, engage new partners in the global science community, and leverage precious scientific and logistical resources so that, in essence, we get more from our investments.

Why should the vast majority of us, who live in the warmer regions of the Earth, care about IPY? The polar regions, while physically distant, are critical links in the global climate system. Does this matter for the rest of the planet? Imagine holding an ice cube between your thumb and your forefinger. Beneath your fingers a pool of water forms quickly. The water will drip down your arms and down the ice cube. The changes at the end driven by the warmth of your fingers are transferred across the entire ice cube. The relationship between the poles to the rest of the globe are the same. The polar oceans play a critical role in maintaining ocean currents that keep coastal Europe much warmer than it would be otherwise, and the sea ice cover modifies Earth's surface temperature by reflecting solar energy. Melting ice sheets will raise sea levels, threatening coastal communities around the world. The polar regions are integral components of the Earth

system that both respond to and drive changes elsewhere on the planet.

The polar regions also hold unique information of Earth's past climate history, and they are growing in economic and geopolitical importance. They are a unique vantage point for studies that will help scientists understand environmental changes in the context of past changes, which in turn will help us make informed choices for our future. The exploration of new scientific frontiers in the polar regions also will lead to new discoveries, insights, and theories potentially important to all people.

In summary, International Polar Year 2007-2008 will leave us important legacies:

- an improved understanding of environmental status and change,
- more comprehensive data and the ability to understand trends in the future,
- improved observation systems to capture future environmental change,
- a continued spirit of exploration into new frontiers of science,
- a new and inspired generation of scientifically literate citizens and leaders,
- an enhanced level of international cooperation to address global scale issues.

Thank you for your time. I'd be happy to answer any questions.